The Mint of the United States,

AT

PHILADELPHIA, PENN.,

Assay Department, August 15, 1879.

Hon: A. London Snowden

Superintendent &c &c

Sir

Without feeling any disposition to debate or contend, it seems necessary that some reply should be made to the documents lately sent from the U. S. Assay Office at New York, to the Director, in regard to the presence and effect of Selenium, in Silver.

As a matter of "theory", or hypothesis in which light both the Superintendent and the Assayer place it, we should not think it worth while to pursue the subject, but as a matter of fact, and of practice, it is highly interesting, and would be very important, except that we are, happily, not often troubled with it.

RG104 E-1 Box 118

We were not aware, that the operative officers at New York had suspected, ~~three~~ two years ago, the presence of selenium or selenides, as a cause of rendering their silver brittle, and had not succeeded in finding it. As you are aware, we were started in this inquiry by the report of a chemist and metallurgist in France. So far as we know, the matter has even eluded the vigilance of the British Mint, or any other Mint. And it was truly a matter of surprise, that here, in almost atomic minuteness, should be found a worse enemy than any we had hitherto found, or searched for.

Without delay, this selenium business, both by analysis and synthesis, was put into the hands of our Mr Eckfeldt & Mr. Outerbridge, to operate independently. From them I have concurrent results, which I will now condense for your consideration. We had none of the suspected acid, or copper; but we had brittle silver bars from New York; and we had other silver, and pure selenium, and pure copper.

RG104 E-1 Box 118

The six samples sent back to New York, were all found to contain selenium, here; but only two, there. - In testing for this element, if the last trace of nitric acid used to dissolve the alloy, is not eliminated, the characteristic reactions do not take place. It is easy to fail from this cause, even when selenium is present in considerable quantity.

The Assayer there, finds no selenium either in the acid or the copper now used; which is very satisfactory. It may, however, have contaminated both, when the bars in question were refined, months ago. No doubt the present inquiry will be of use to keep it out in future; and in that respect, they will rejoice with us.

The two samples of silver ingots rolled, or vainly attempted to be rolled, are handed to you herewith, and are every way remarkable and instructive; and show that we are not dealing with theory, but with practice.

RG104 E-1 Box 118

No. 1 was made of fine Silver, brought to 999 by selenium and lead; we may say a trace only, of each. After assay, it was alloyed with pure copper, to standard. You observe that nothing could be more refractory, and unfit for use, in coinage, or in the arts.

No. 2., composed in the same way but free from lead, is if possible even worse than No. 1; wonderfully hard and brittle.

These results are very different from those obtained by the Assayer at New York, who finds that selenium does not impair the toughness of silver, either fine or alloyed.

In further experiments made here, we find that if the mixture is tolerably ductile before the addition of copper, that very addition, of the best copper, will destroy the ductility; and this trouble occurred in the alloying and working of bars, bearing the N.Y. stamp, whether refined there, or elsewhere.

Very respectfully

W. E. DuBois

assayer

(over)

RG104 E-1 Box 118

Supplementary Note.

H. OWEN

Since the foregoing was written, our Melter & Refiner has shown me his remarks upon the matter re-opened by the Melter & Refiner at New York, in regard to refining copper out of the silver, only to put it in again.

Our M & R has given a clear review of the state of the case; and I would take occasion to add, that everywhere, so far as we are aware, silver is bought to ~~fineness~~ fineness, or nearly so, before it can be considered negotiable, or fit for manufacture or market. The only exceptions are doré (partible) silver, or silver which has been expressly alloyed to standard, or sterling fineness. The native mixtures are not at all merchantable.

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There is therefore nothing unreasonable, in our asking to be supplied with fine silver for our work; or else, (which does not often present itself) with silver melted down from coin; that is, if we are to make no refining and melting charges.

Still, it will strike most persons, not familiar with the subject, as a useless and even wasteful proceeding, to remove the copper, and put copper back. And I would therefore put it in the form of a query, not to say a doubt, whether we have sufficiently tried to dispose of this difficulty, in the large way. I do so because an experiment lately made in my department, in the small way, seems to prove that ~~the~~ either gold or silver, however brittle, and alloyed with copper, may be made perfectly tough by a very simple method.

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While our Mr. Outerbridge was detailed for duty at the re-opening of the New Orleans Mint, he chanced to fall in with a gentleman from Mexico, who has the management of several mints there. He was ~~somewhat~~ conversant with this very subject; and stated that all their silver was made perfectly tough by the addition of a very small quantity of oxide of copper, in the process of melting. The oxygen left the copper, to assimilate with the other base and embrittling metals or elements, and carry ~~ing~~ them off; leaving ~~an~~ its own metallic copper, which only served a useful purpose as an alloy. This method, it is true, is in some of the books, but seems to have attracted very little attention hitherto.

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A small quantity (four ounces) of brittle, coppery gold, was tried in this department; "the smallest pinch" of oxide of copper made the gold perfectly ductile. And what it will do for gold, we may surely expect it will do for silver. At any rate, it needs to be tried, in the large way. But then, the trials should be made at New York, before the silver is forwarded; otherwise we are put to the expense & waste of the previous melting, without any allowance of charge or wastage therefor. And besides, the Institution at New York professes, and certainly intends and wishes, to give us silver ready to put into ingots.

Once more, the spirit of candor will make us prompt to admit, that faulty rolling, and cracking, is not always due to

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a fault in the metal. Only two days ago, we made an ingot of proof silver for assays, chemically pure; and it came through the new rolls, in the rolling-room, badly cracked and broken, ~~very badly~~. This was from some inattention in adjusting the rolls, or in running the strip through. The same thing has happened in our small rolling. This however is of rare occurrence, and does not at all clash with the matter now in hand, the presence of metals or elements which produce brittleness, and which has, as you know, sometimes returned large quantities of split and broken strips, to be remelted and refined.

Very respectfully,
W E DuBois
assayer

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5664

U. S. Mint at
Philadelphia
Aug 15/79

W. E. DuBois
Assays

Reply to M & R and
Assays, N. Y. Assay
Office, in regard to the
presence of Selenium
in Silver. Facts and
practice vs. theory.
Toughening gold
& silver by a small
quantity of oxided
copper, in melting.

Rec'd Aug. 15th 1879.

RG104 E-1 Box 118

NARA RG104, Entry 1, Box 118

[Abstract:] Reply to M & R and Assayer, N.Y. Assay Office, in regard to the presence of selenium in silver… 566 ¼

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At Philadelphia, Penn.,
Assay Department,
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